California Department of Food and Agriculture
Hydrilla Eradication Program 2001

- Program Review, Dec. 03, 2001
  - Project Results
    - Robert Leavitt and Patrick Akers

Hydrilla Eradication Program- Conceptual Model-invasiveness and weediness

- Hydrilla is an aquatic vascular weed that reproduces by fragments, turions, and tubers
- Hydrilla blocks water storage and movement in lakes, reservoirs, streams, canals, drains and other water delivery systems; blocks water control structures and hydroelectric dams; impedes navigation; and endangers public health
- Hydrilla is not native to California, displaces native plants, and harms native wildlife and fisheries

Hydrilla Eradication Program- Conceptual Model, Eradication Program

- Quarantine, Exclusion and Public Awareness are required to prevent spread of fragments, turions, or tubers,
- Surveys and Public Awareness are required to find and detect hydrilla infestations while as small as possible,
- Eradication of existing infestations requires
  - Frequent and recurrent elimination of top growth to prevent tuber formation
  - Elimination of tubers from the tuber bank
  - Screens on outlets to prevent movement of plant fragments
- Water monitoring is necessary to demonstrate water quality not impaired

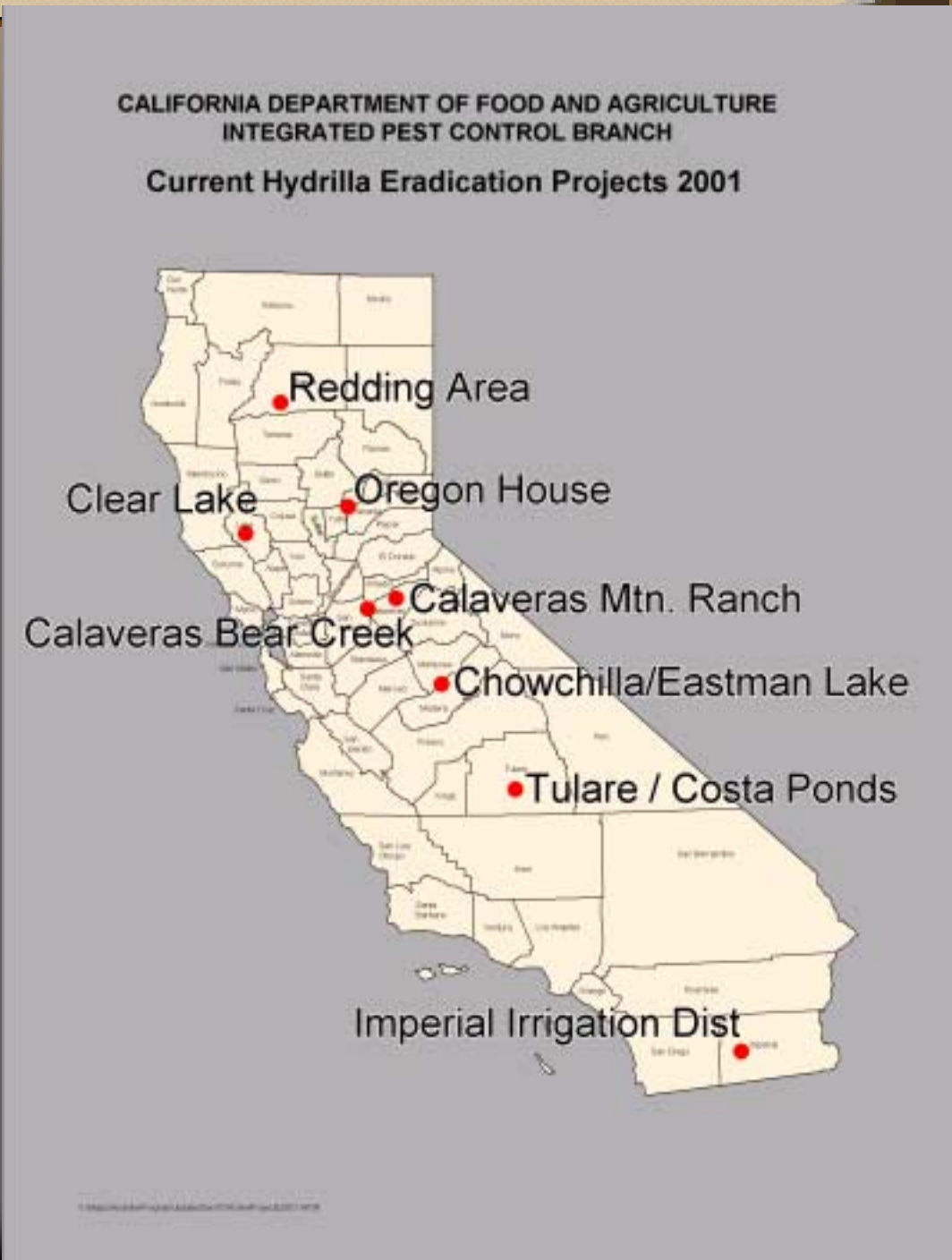
Hydrilla Eradication Program- Conceptual Model, Eradication Program, cont'd

- Chemical treatments and surveys continue for 3 years after last plant detected
- Surveys continue for minimum 3 years after chemical treatments cease
- After minimum 6 years of no detections, hydrilla can be declared eradicated from an area

Hydrilla Eradication Program 2001

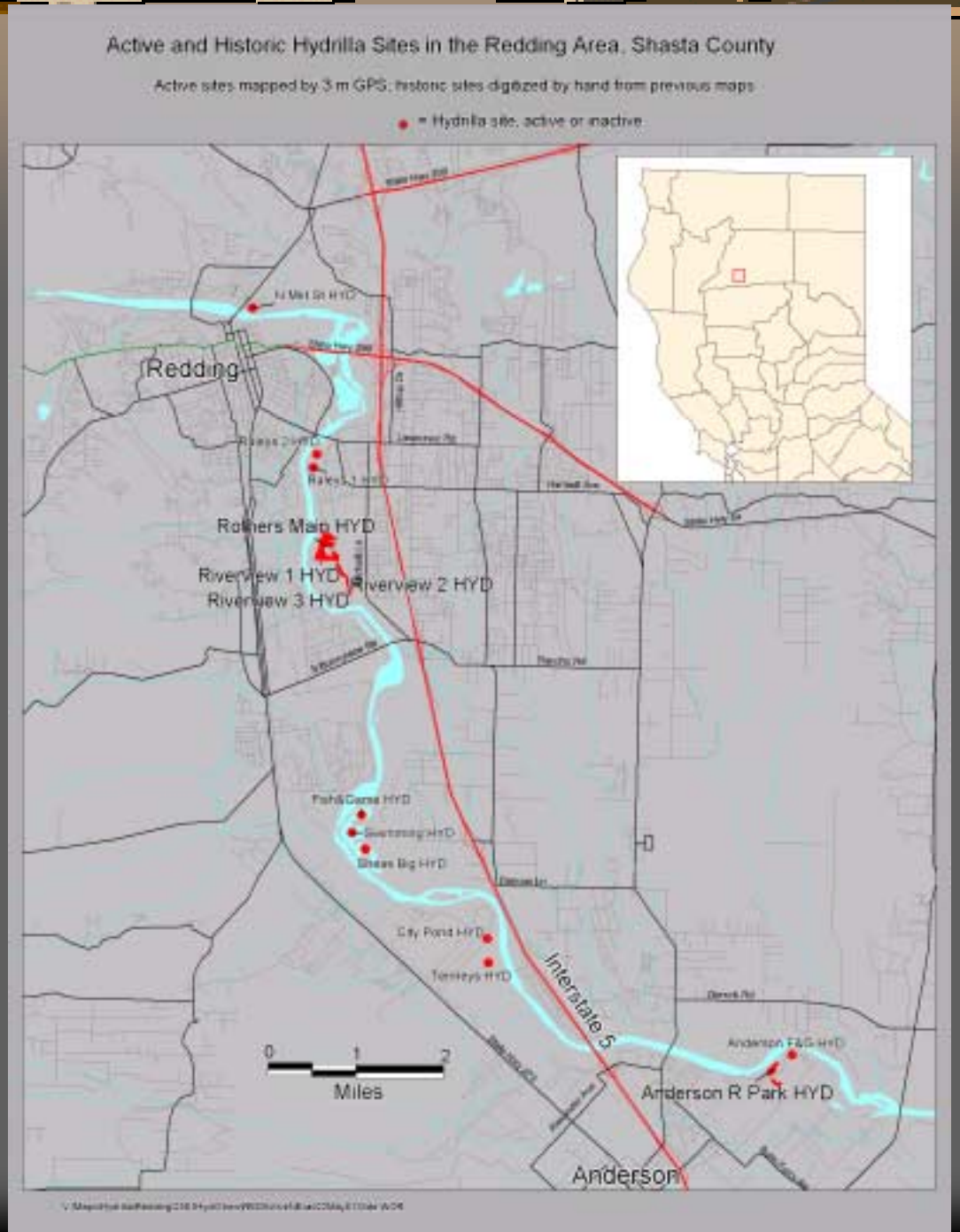
- 2001 Project Review
  - Surveys, treatments, and preliminary results
  - Compare to previous years results where possible
  - Review each project in following order:
    - Pat Akers: Redding, Yuba County, Clear Lake
    - Robert Leavitt: Calaveras County, Madera and Mariposa Counties, Tulare County, Imperial County, Delta Hydrilla Survey

Active Hydrilla Projects Statewide in 2001



Redding ponds 2001

- Local leadership
  - CAC: Mary Pfeiffer
  - CDFA: Ed Finley, Carri Pirosko
- Components
  - Quarantine
  - Survey
  - Herbicide Treatment
  - Public Awareness



Redding Ponds Eradication History

- Since 1986, 17 ponds in the Redding area have been found infested
- As of 2001, hydrilla has been eradicated from 12 of these ponds (3 were buried)

Redding Ponds 2000/2001 Surveys

- Surveys
  - Survey of 20 ponds and 7 creek sites inside eradication area
  - Survey of 36 ponds, 45 creek sites and 12 lakes outside of eradication area
  - Survey of Sacramento River at 11 access points
- No hydrilla detected except in Rother's/Riverview complex

Redding Ponds-2001

Redding Ponds-2001, Ponds under Active Eradication					
		Level of Infestation			
site	size	year			
	acres	1996	1999	2000	2001
		% cover			
Rother's Pond	30	2%	0%	<0.01%	<0.01%
Riverview Golf Course 1,2,3	9	35%	2%	1%	<0.01%
Anderson Big Pond	6	n/a	<0.01%*	0%	0%
Anderson Bridge	3	n/a	0%	0%	0%
Rother's Pond and Riverview 1,2,3; hydrilla first detected in 1996					
Anderson Big Pond and Anderson Bridge: hydrilla first detected in 1994					
*Anderson Big Pond surveyed by divers in 1999; all other numbers from surface/boat surveys					
Rother's Pond: 2% cover is from "15/30 scattered or clumpy"					
Riverview 1,2,3: 35% cover is from "9 acres moderate to heavy"					
<0.01 % cover = 1 to 13 plants					

Redding Ponds 2001-treatments

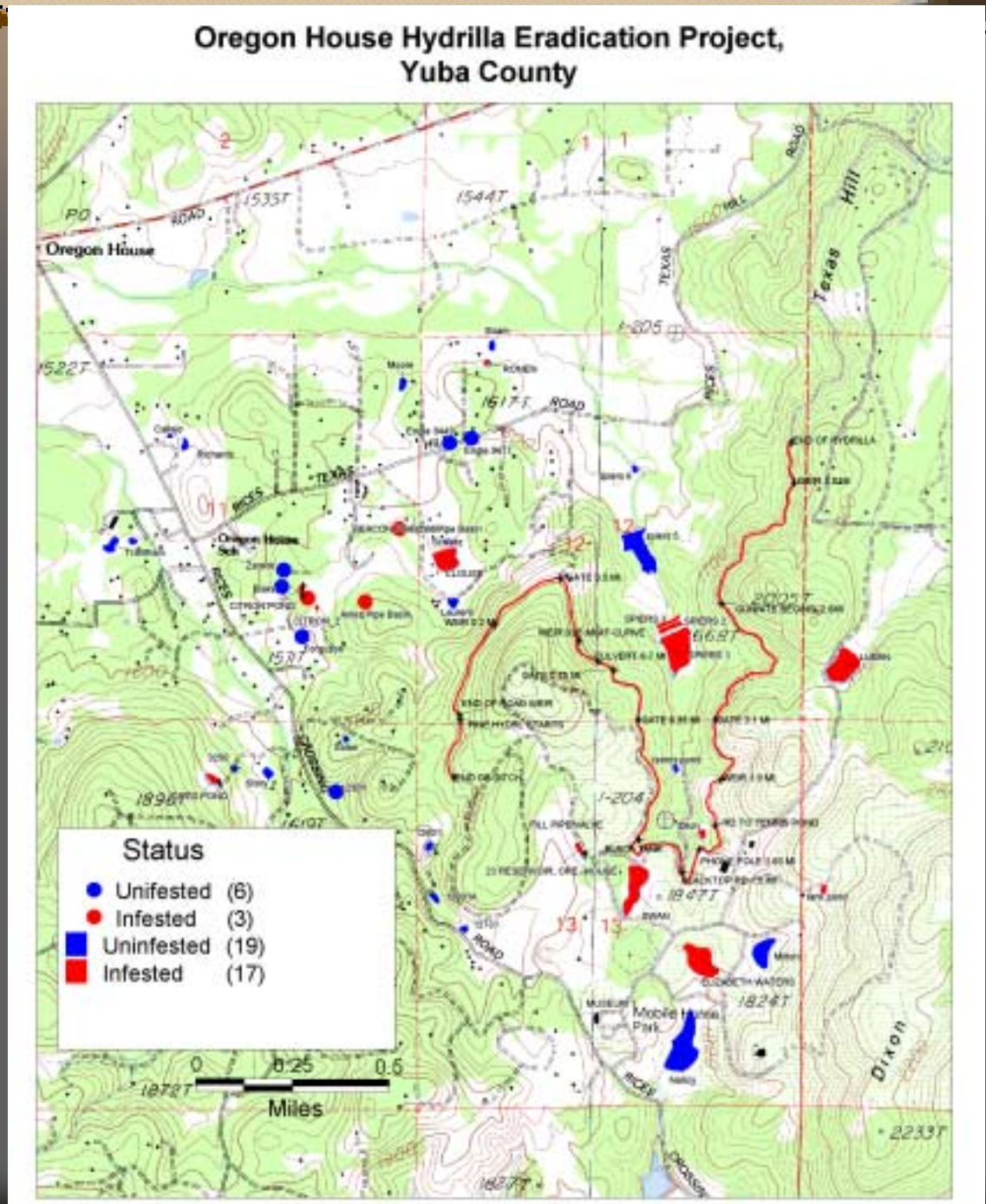
- Rother's Pond (spot treated only when hydrilla is detected), treated with 15 gal copper total for season.
- Riverview #1, treated with fluridone SRP, three treatments at 50 ppb, begin on June 12th, then monthly.
- Riverview #2 and #3, treated with fluridone AS at 5 ppb on a weekly interval, begin on June 11th, completed Oct. 29th.
- Big Anderson Pond treated with fluridone every six weeks.

Yuba County-Yuba Co. Water District Canal and nearby ponds

- Local leadership
  - CAC: Dennis Pooler
  - CDFA: Ed Finley, Ross O'Connell, Rod Kerr
- Components
  - Quarantine
  - Survey
  - Research in cooperation with UC Davis
  - Manual removal, Dredging, Herbicide treatment
  - Public Awareness

Yuba County Infestation Overview

- Headwaters: 3.1 miles of infested irrigation canal
- 15 infested ponds, <0.1-3.7 ac
- 3 used for irrigation



Yuba Co. Water District Canal

- 3.1 miles of canal infested
  - Key to controlling hydrilla infestation
  - Screened to prevent movement of hydrilla fragments
  - Manual removal from top ¼ mile
  - Dredging slow and only partially successful because of soil type: clayey with rocks
  - Research on acetic acid to control tubers in hydrosoil

Yuba Co. Water District Canal

acetic acid treatment: fall 2000

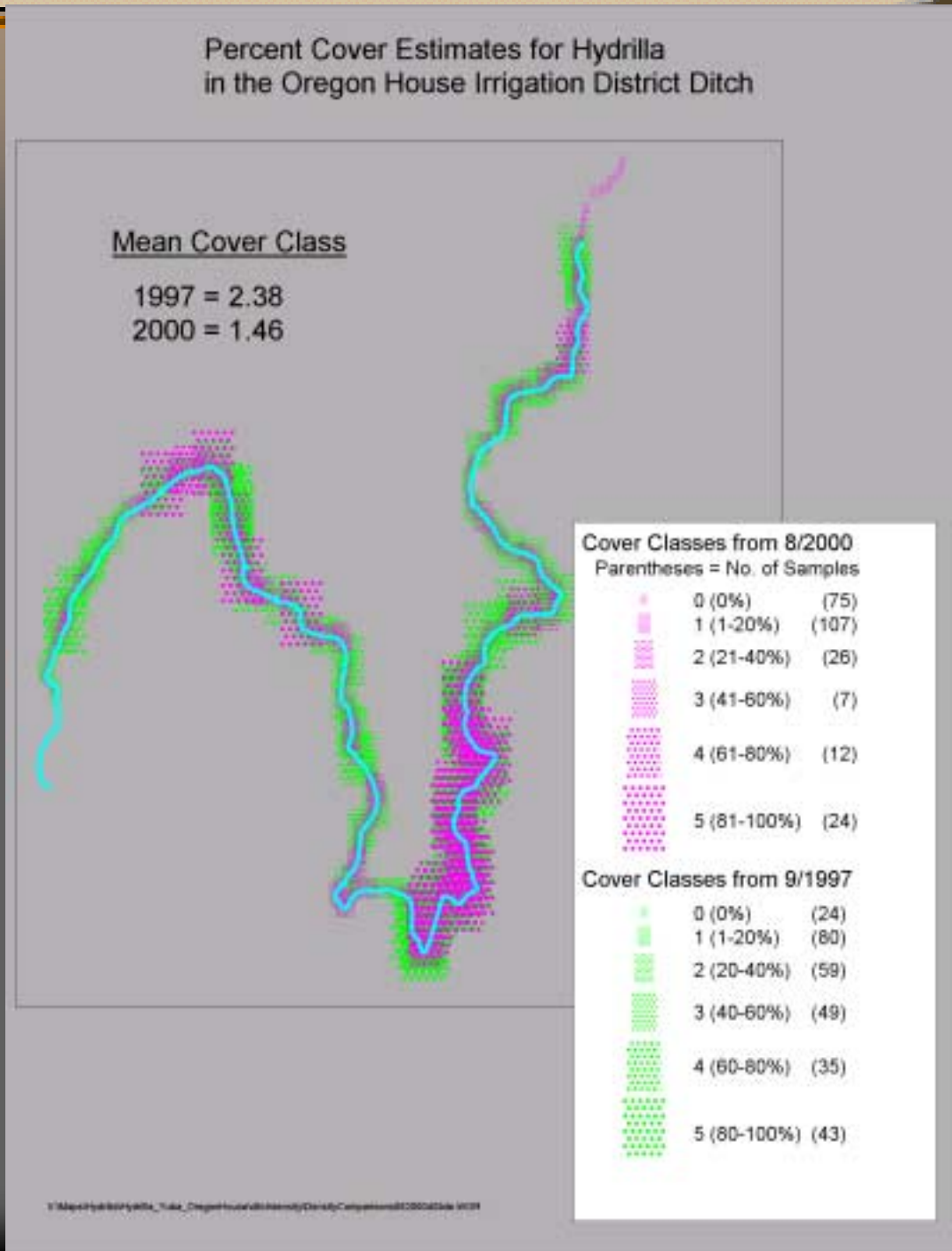
Yuba Co. Water District Canal: Treatment 2001

- New, innovative treatment protocol begun 2000
  - Copper metered into the flowing canal for 4 hours
  - Three metering stations one mile apart
  - Station 1, 7 gal; Station 2, 5 gal; Station 3, 3 gal
- Treated 4 times with copper
- First tmt 05/31/01, last tmt 09/05/01
- Visual inspection: tmt appears to be effective in reducing plant biomass

Canal Density Estimates

1-meter quadrats;
position recorded by GPS;
visual estimates into 6 classes;
1997 and 2000

To be repeated in 2002



Canal Density Estimates

Core samples taken at fixed intervals along length of Canal and sifted for tubers. By David Spencer and Greg Ksander of USDA-ARS.
(to be repeated in 2002)

Date	No. of Samples	Mean Tubers/m^2	Lower 95% Confidence Limit	Upper 95% Confidence Limit
Sept. 17, 1998	98	315.28	193.58	436.98
Oct. 24, 2000	156	84.882	44.134	125.63

T-Test: DF=119, t value = 3.56, Probability of greater t = 0.0005, unequal variances

Conclusions on Canal Treatment

- Surveys show modest improvements but not those typical of most eradication campaigns after 4 years of treatment
- Due to attempts to avoid disruption of service, which leads to difficulty in managing water in canal
- New metering technique may provide needed improvements, or more effective approaches need to be pursued.

Yuba county-ponds 2001

- Hydrilla first detected 05/08/01 in Speirs #1 and Citron ponds
- Irrigation ponds- Renaissance Winery
  - 3 infested ponds (Ditch, Tank, Reservoir 23)
  - Treated with copper 4 times with variable results
- Non-irrigation ponds
  - 8 infested ponds treated with fluridone with good results
  - 2 ponds treated but no hydrilla detected since 1999-Clouse and Ronen ponds

Yuba: Spiers Pond #2

1997

2001

Yuba Co. Eradication Area Surveys

- Collins lake, Englebright reservoir
- 40 ponds
- No new hydrilla detected

Clear Lake Project 2001

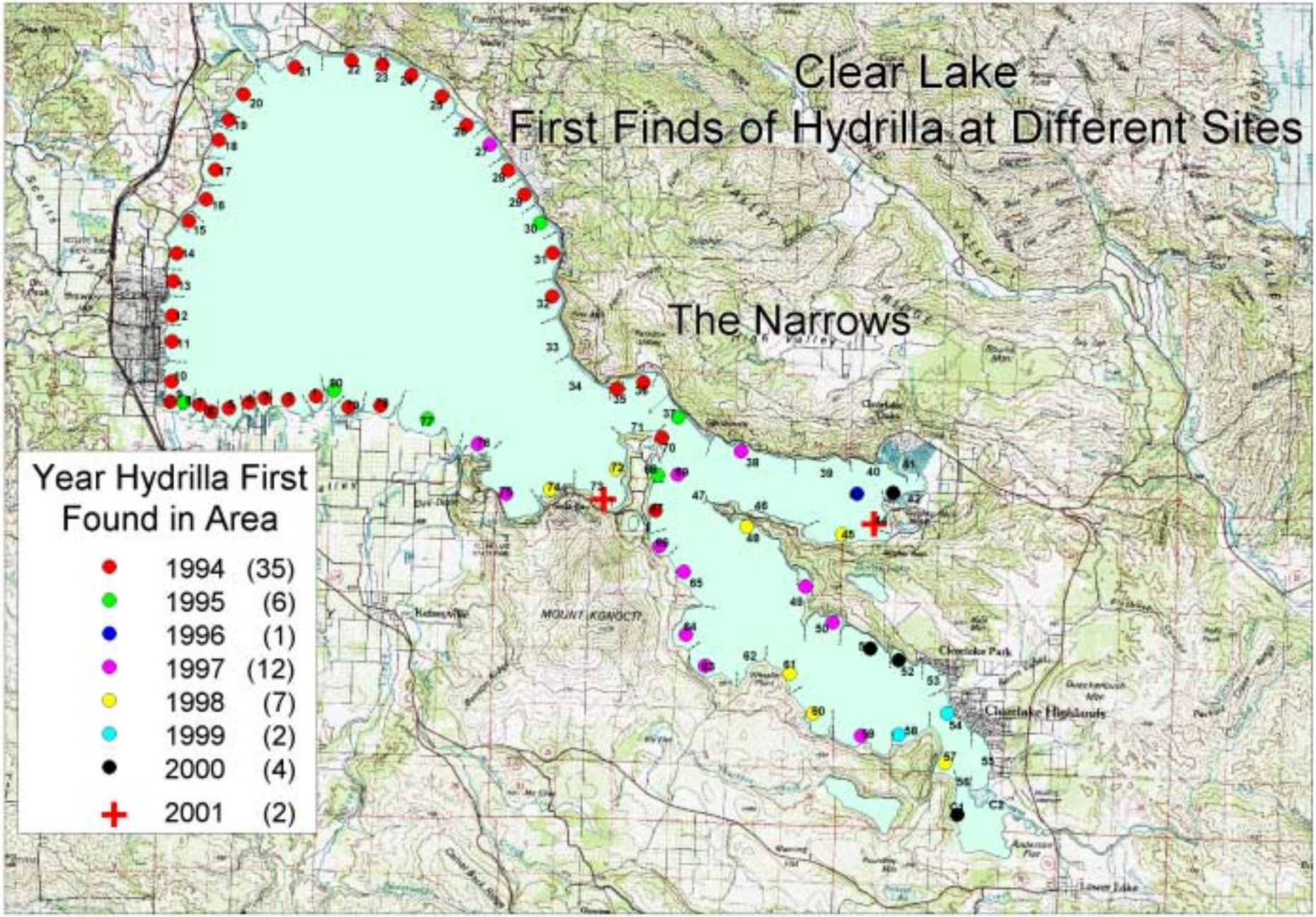
- Local leadership
  - CAC: Mark Lockhart
  - CDFA: Bob Hesterberg, Robin Breckenridge
- Components
  - Quarantine
  - Survey and Detection
  - Research in cooperation with UC Davis
  - Treatment
  - Public Awareness
  - Water Monitoring

Survey Efforts and Results

- Clear Lake
  - 965 surveys on 82 mgt units (11.8 per area)
  - First hydrilla found May 29, in Unit 50 (previously infested)
  - Newly infested units: 44, 73: MAP
- Surrounding areas
  - Surveys also on Indian Valley Reservoir, Highland Spring Reservoir, Lake Pillsbury, Blue Lakes, Thurston Lake and surrounding streams and rivers
  - No hydrilla detected outside of Clear Lake

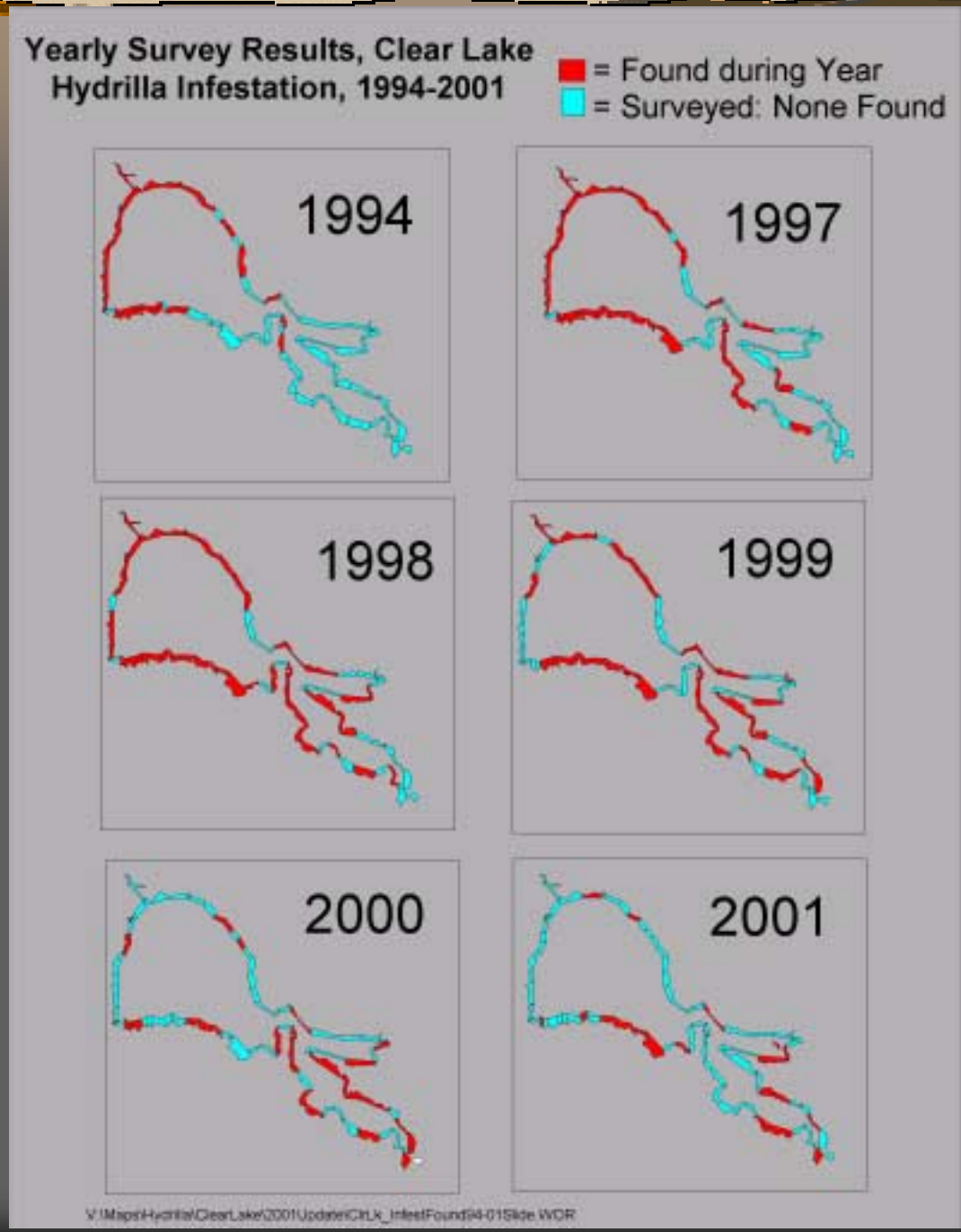
Clear Lake-History

- First detected August 1, 1994
- First treatments about 2 weeks later
- Complete survey in 1995, including shoreline of lake (1/4 mile out) and tributaries


Clear Lake
First Finds of Hydrilla at Different Sites
The Narrows
Year Hydrilla First Found in Area
1994 (35)
1995 (6)
1996 (1)
1997 (12)
1998 (7)
1999 (2)
2000 (4)
2001 (2)
Clearlake Park
Clearlake Highlands
Lower Lake
V:\Maps\Hydrilla\ClearLake\2001Update\ClrLk_InfestFound94-01Slide.WOR

Survey Results

- Hydrilla continues to disappear from treated units, especially in upper arm.

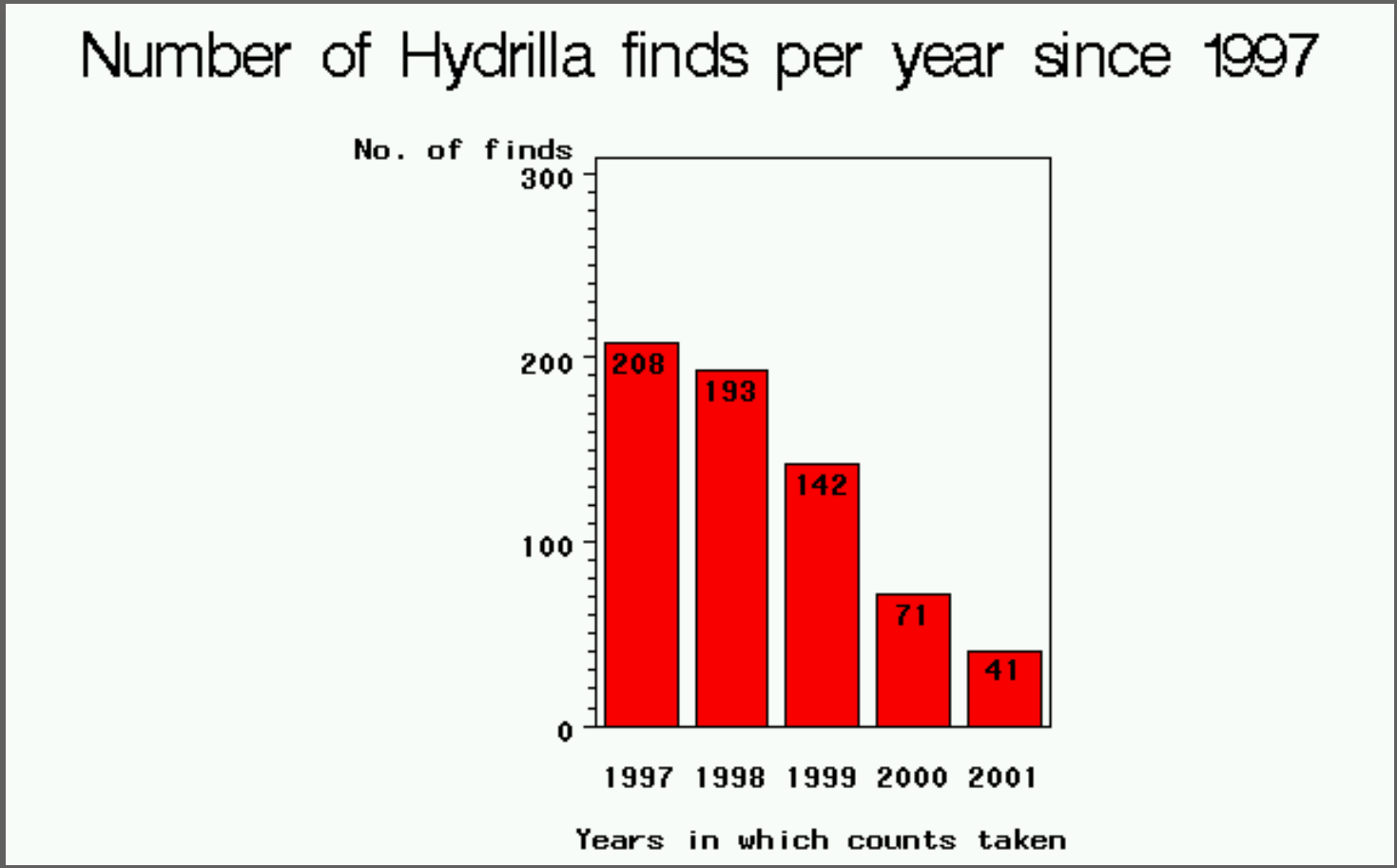


Survey Efforts and Results

- Number of Clear Lake mgt. units where hydrilla was found in 2001: …….. 21
-

Year	Area
1997	48
1998	55
1999	45
2000	31

Clear Lake Hydrilla Eradication Program



Herbicide Treatment

Copper herbicide for quick removal of biomass

Fluridone herbicide for mortality of germinating tubers/seedlings

Copper Treatments 2001

- 1390 gallons applied to 62 acres
- First treatment: May 31
- Last treatment: October 15

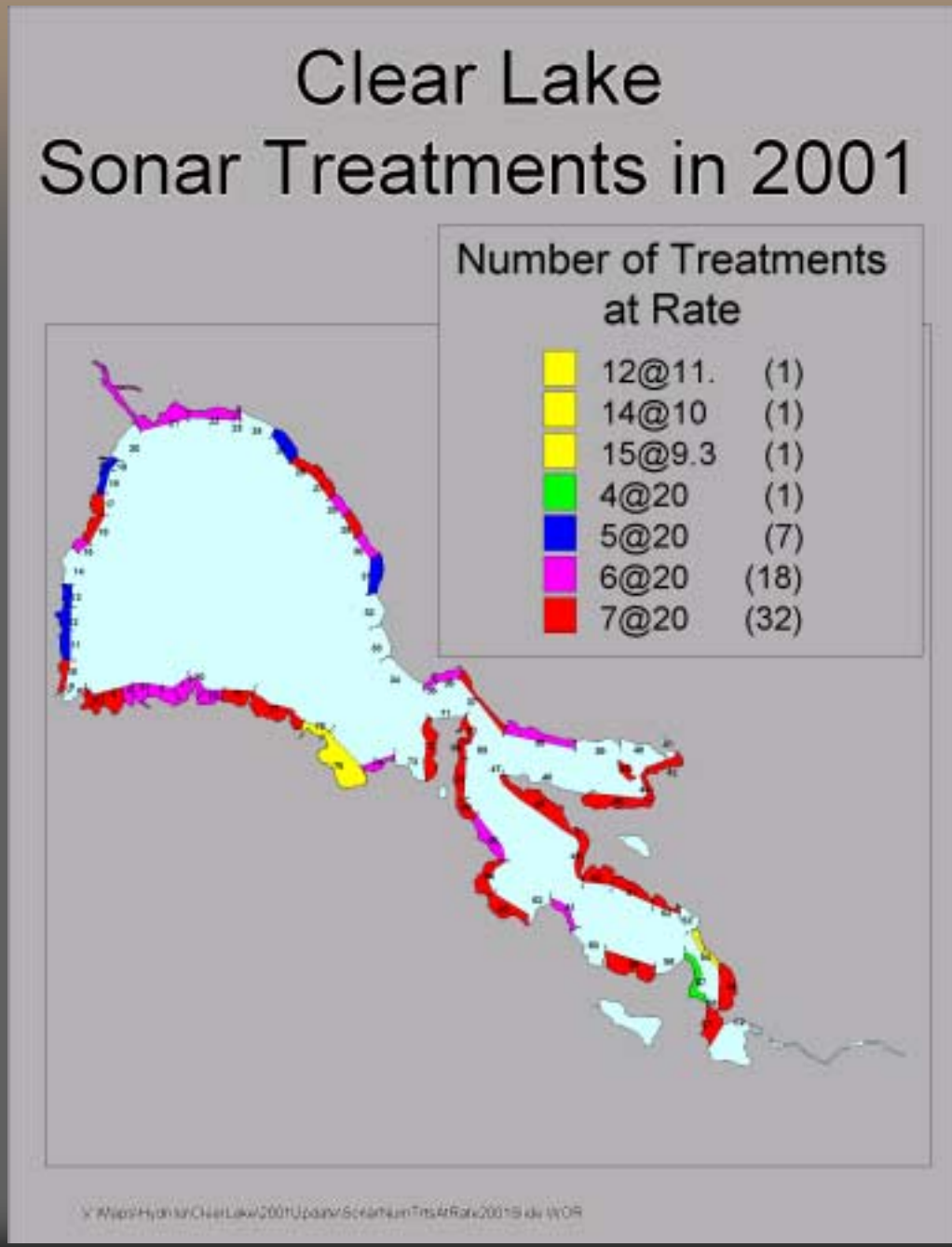
Fluridone Treatments 2001

- Used 56,776 lbs. of SRP, 168 oz. of AS
- Treated 1,335 acres in 61 mgt units
- First treatment: May 21
- Last treatment: November 1

Clear Lake

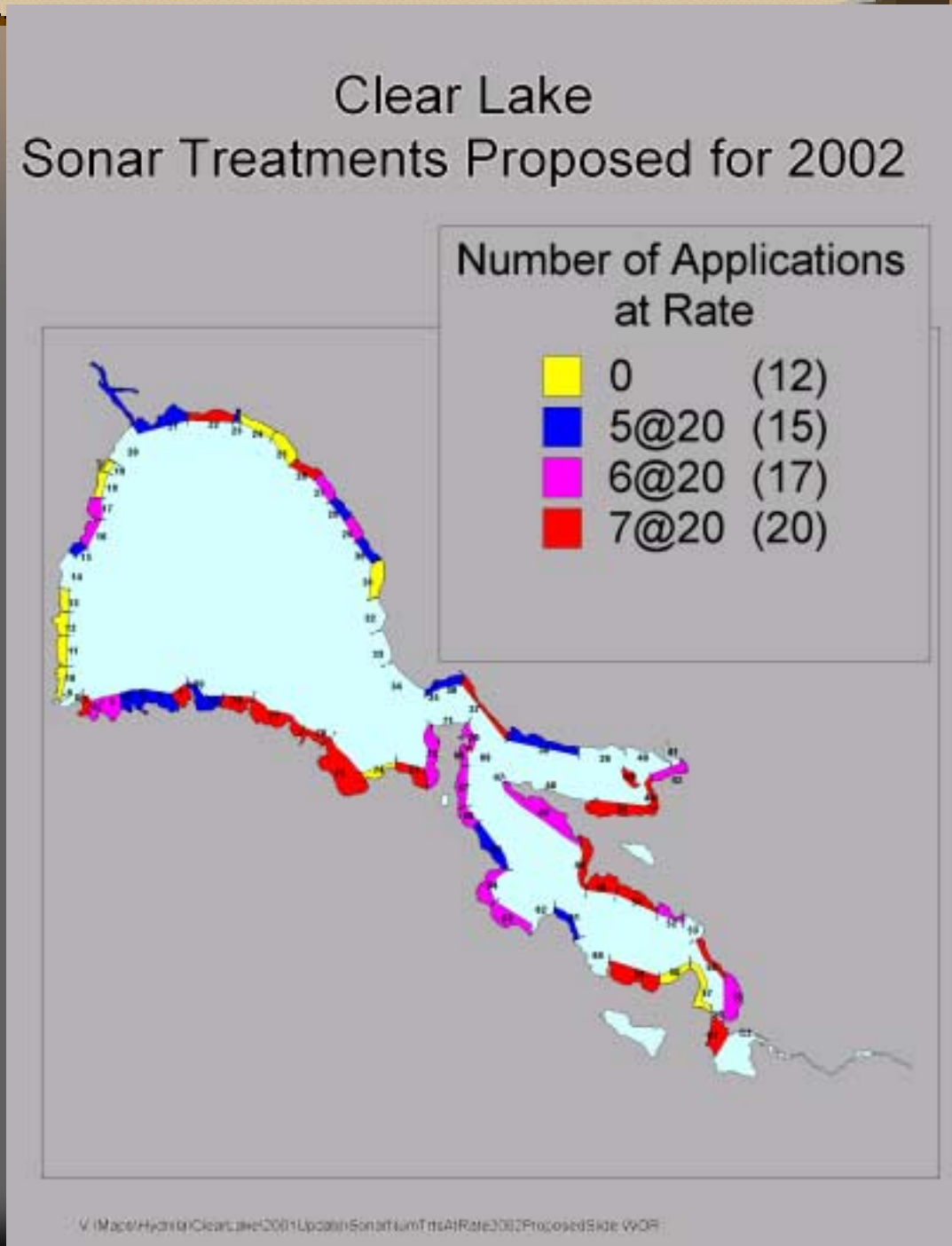
Fluridone Treatments 2001

- Most treatments were 7x@20 ppb or 6x@20 ppb
- Beginning to decrease rates in units where hydrilla is disappearing



Fluridone Treatments 2002

- Rates and numbers of units treated are slated to decrease
- Acres treated may remain same because of Unit 75



Clear Lake Mgt. Unit 75

Clear Lake-Public Awareness-2001

- Notices of Intent and pamphlets to Homeowners on lake: 1304
- Pamphlets to businesses and government agencies: 400
- Public presentations:
  - CDFA: 1 to Yolo County Flood Control and Water Conservation District
  - CDFA: 1 to Lake County Board of Supervisors (CDFA) followed by newspaper article
  - Ag Commissioner: numerous public contacts

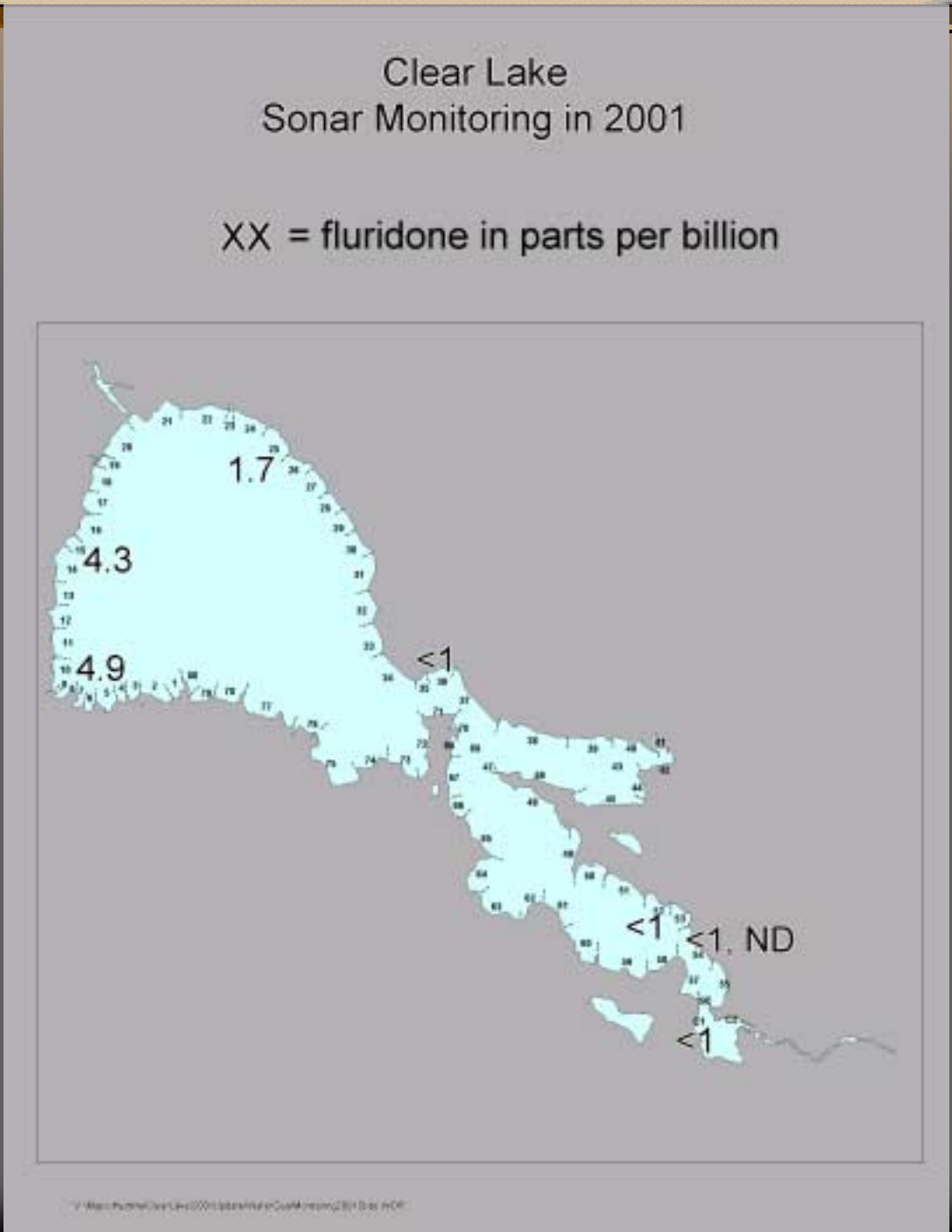
Water monitoring for fluridone

- Results are similar to previous years
- Show only low levels in water column, even near intakes

FLURIDONE WATER CONCENTRATIONS IN CLEAR LAKE, 08/22/2001

Sample site			**ppb fluridone**		
unit no.	description	notes	depth		
			n/a	mid	bottom
26	Upper Arm				1.65
6	Upper Arm				4.85
16	Upper Arm				4.25
36	The Narrows			< 1.0	< 1.0
52	Lower Arm			< 1.0	< 1.0
C1	Channel				< 1.0
54	Water Co. booster sta.	raw water	< 1.0		
54	Treatment Plant	finished water	nd		
*analysis made by SePro, sample taken by SePro and CDFA					

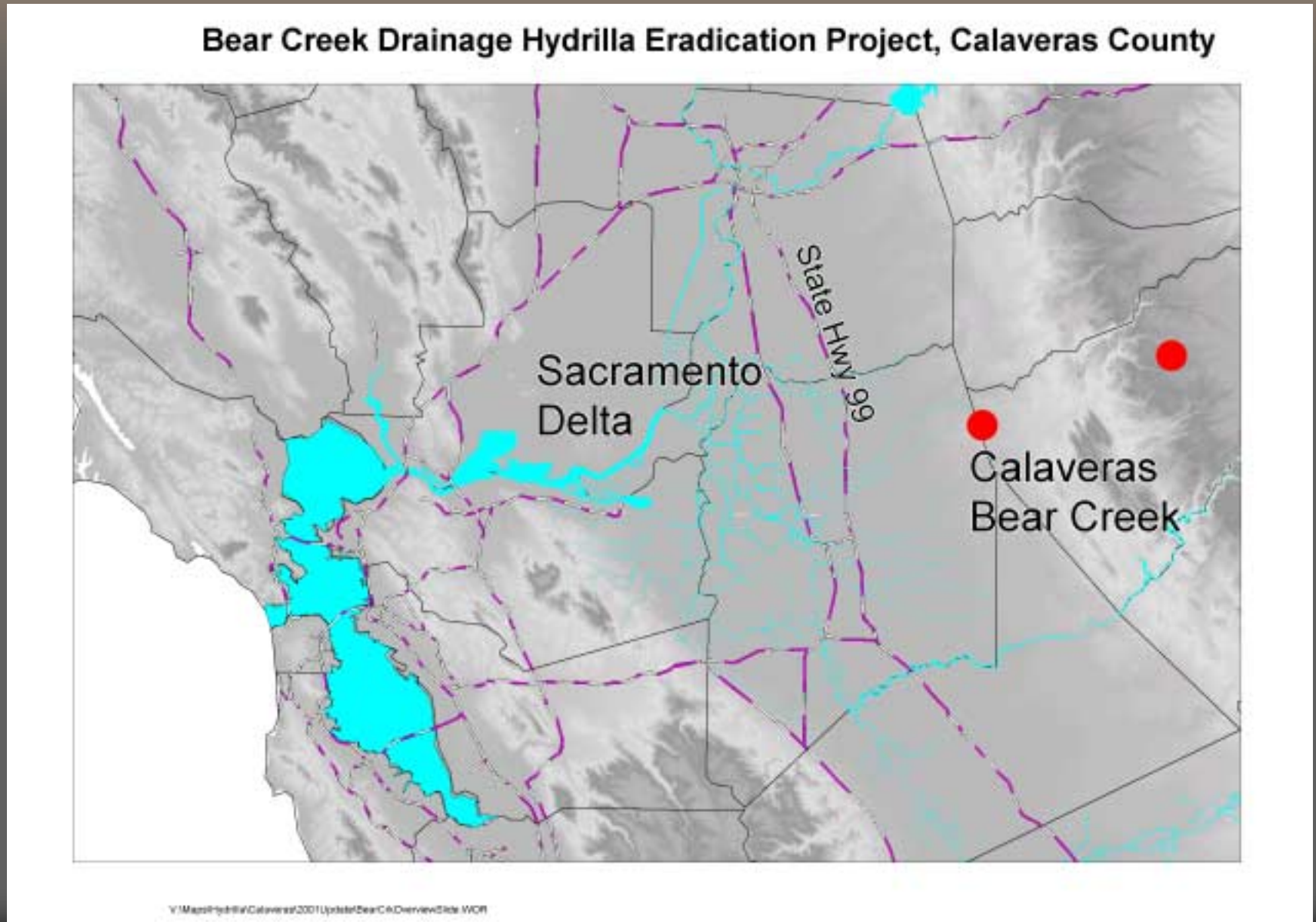
Fluridone Monitoring 2001



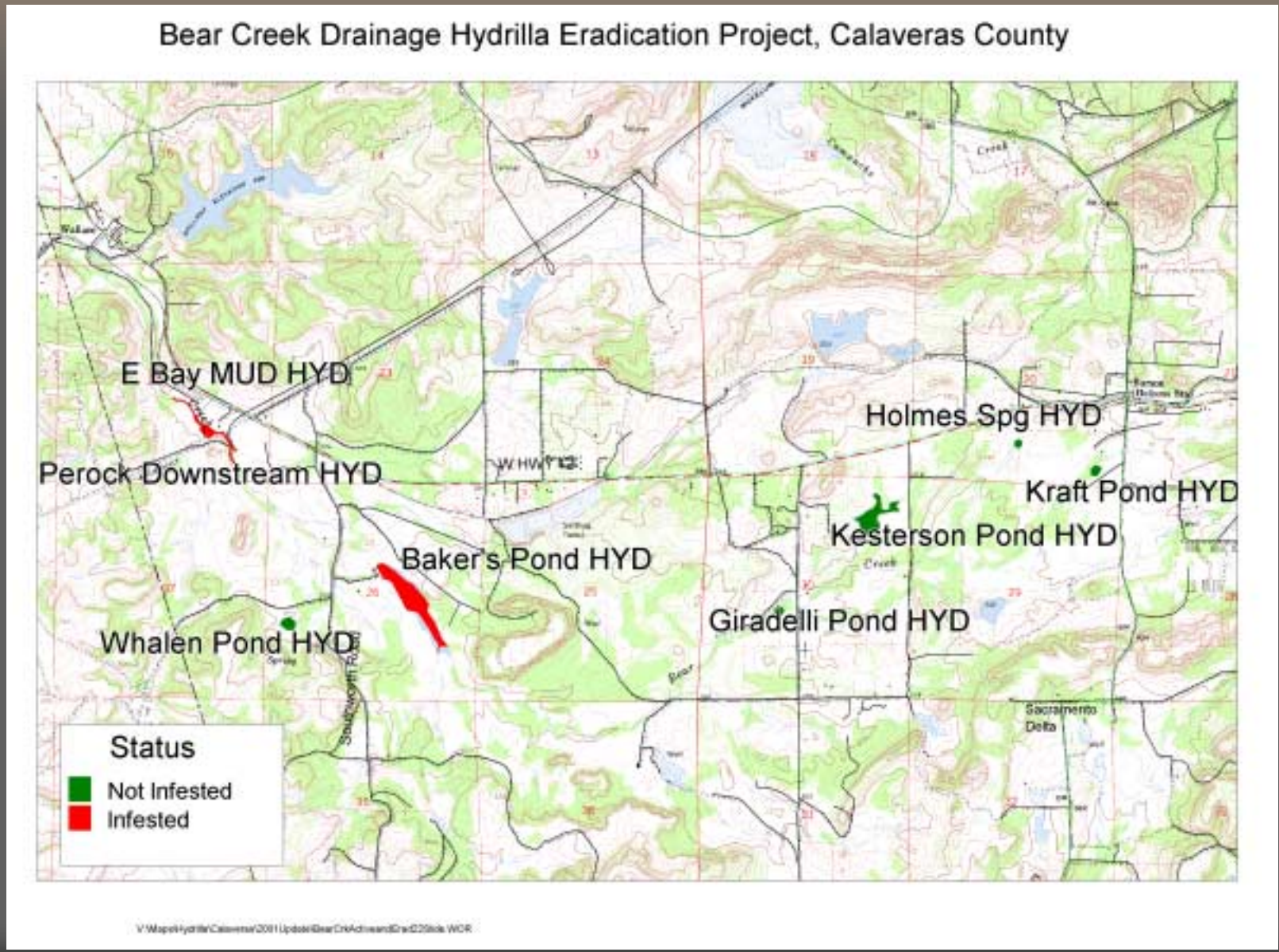
Calaveras County- Bear Creek

- Local leadership
  - CAC: Jearl Howard
  - CDFA: Frank Zarate and Florence Maly
- Components
  - Quarantine
  - Survey and Detection
  - Manual removal, Dredging, and Herbicide treatment

Calaveras County Bear Creek



Calaveras County Bear Creek



Calaveras County Bear Creek

- Of 10 hydrilla finds 1988-1996,
  - 2 eradicated,
  - 7 survey only,
  - 1 find in 2001
  - Last previous finds were in 1999

Calaveras County Bear Creek

- Survey Efforts
  - All ponds surveyed four times
  - Bear Creek: upper part surveyed full length 1x; lower part surveyed 2x at all access points
  - 38 uninfested ponds within 2 mi. of Bear Creek surveyed
- Survey Results
  - No hydrilla found in Bear Creek or in detection survey of ponds in eradication area
  - On 11/14-20/01 10 plants, 33 tubers, and 11 turions found in Hesseltine Pond.

Hesseltine Pond

Calaveras County Bear Creek

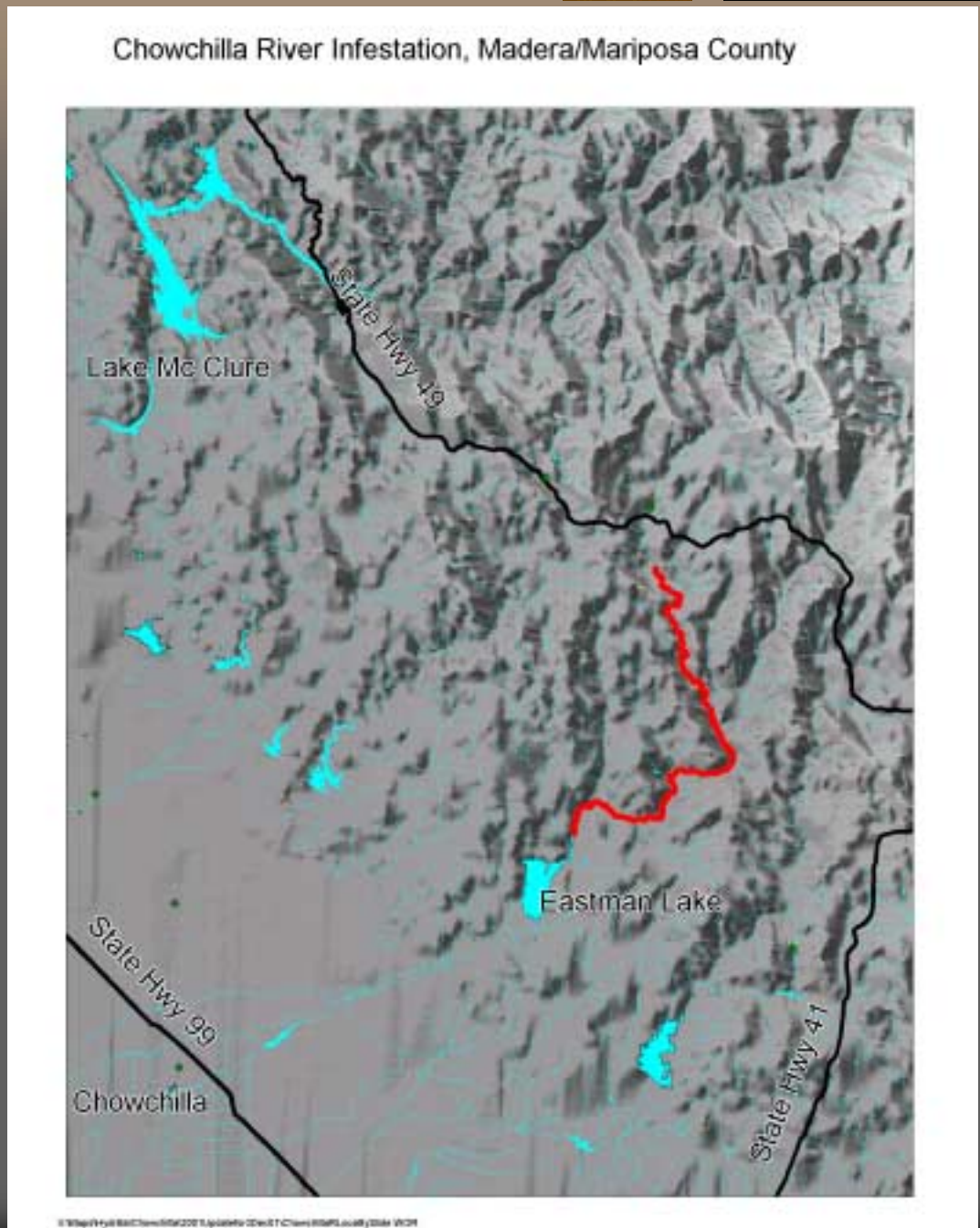
- Treatments
  - 1999 find site treated with 60 ppb total of fluridone (4 applications)
  - 2001 Hesseltine find treated by manual removal, dredging, and copper and fluridone treatment

Chowchilla River / Eastman Lake

- Local leadership
  - U.S. Army Corps of Engineers: Ella Thurston
  - CAC: Robert Rolan / Donald Cripe
  - CDFA: Frank Zarate and Florence Maly
- Components
  - Partial quarantine
  - Survey and Detection
  - Manual removal, Dredging, and Herbicide treatment
  - Public Awareness

Chowchilla River and Eastman Lake

2001



Chowchilla River and Eastman Lake 2001

Chowchilla River / Eastman Lake

- Survey Efforts
  - Each river section surveyed 2-6 times, with “hotspots” more often
  - Eastman Lake surveyed 8 times
  - Water level in Eastman Lake at lowest level since 1992 exposing locations of original hydrilla finds

Chowchilla River and Eastman Lake Survey

Eastman Lake Shoreline 2001

Chowchilla River / Eastman Lake

- Survey Results
  - Only finds: Five plants and two tubers in River Section 2 (below Raymond Bridge).
  - Found on June 26, July 13, July 16
  - All removed manually and areas dug or dredged.
  - Digging/dredging recovered 7 tubers.

Chowchilla River / Eastman Lake

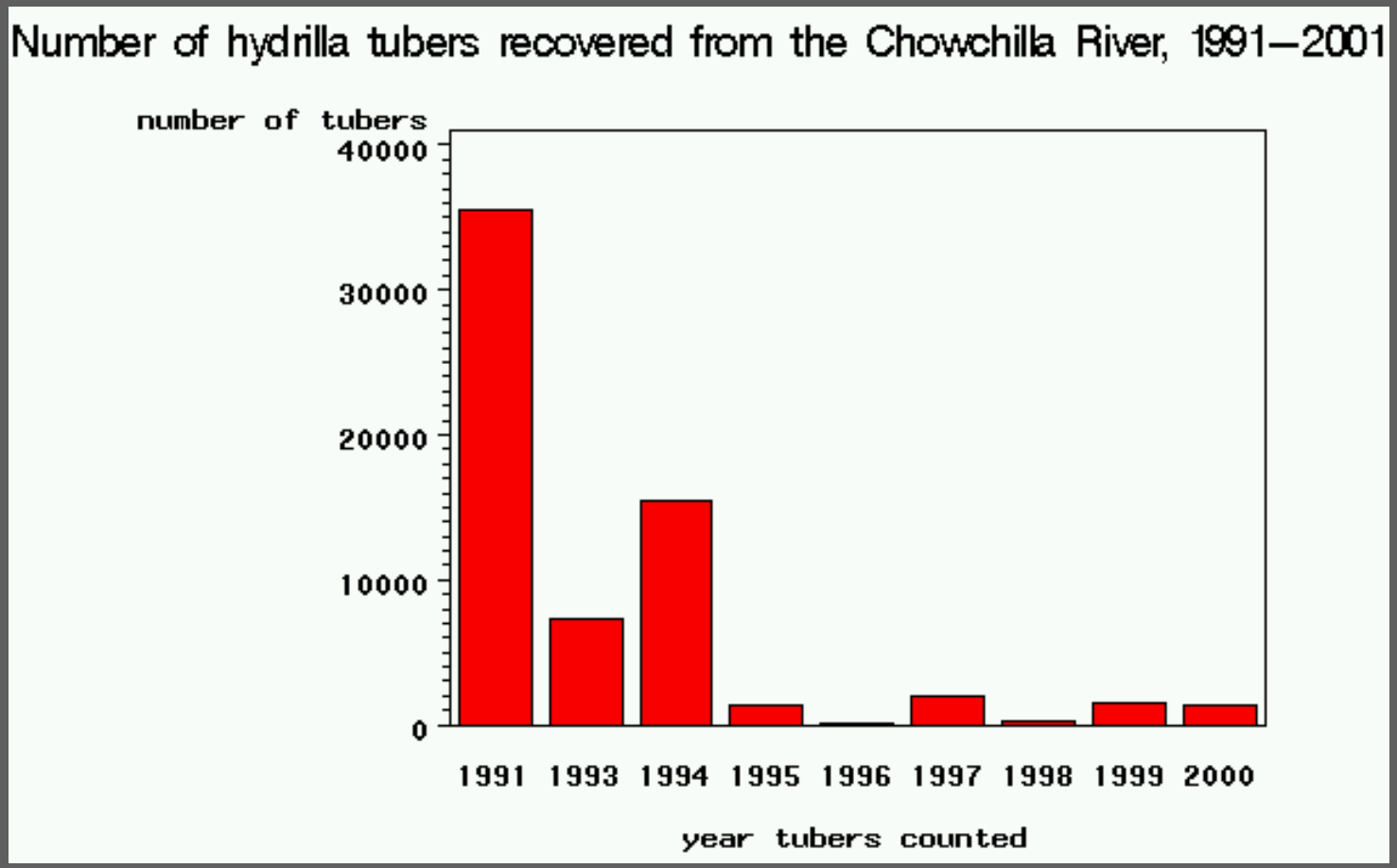
- Herbicide treatments for hydrilla
  - Unit 2 spots: fluridone @ 120 ppb total
  - Four other previously infested spots receive fluridone @ 45-90 ppb total

Chowchilla River / Eastman Lake

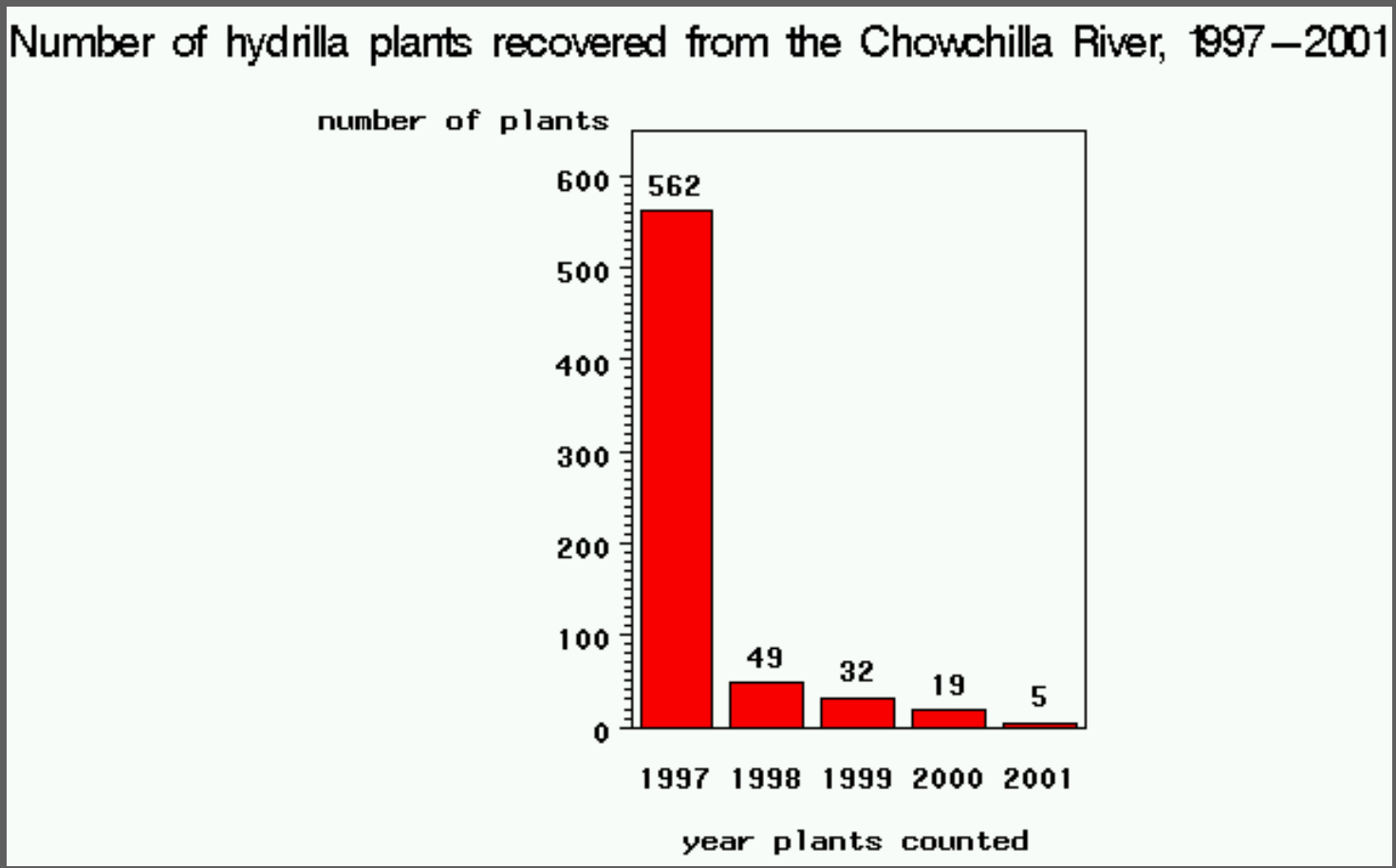
- Dredging
  - Major effort is in Section 38: most upstream; heavily infested historically.
  - Dredging began Nov. 8, 2001 and is on-going

Chowchilla River and Eastman Lake Dredging

Chowchilla River / Eastman Lake: Results

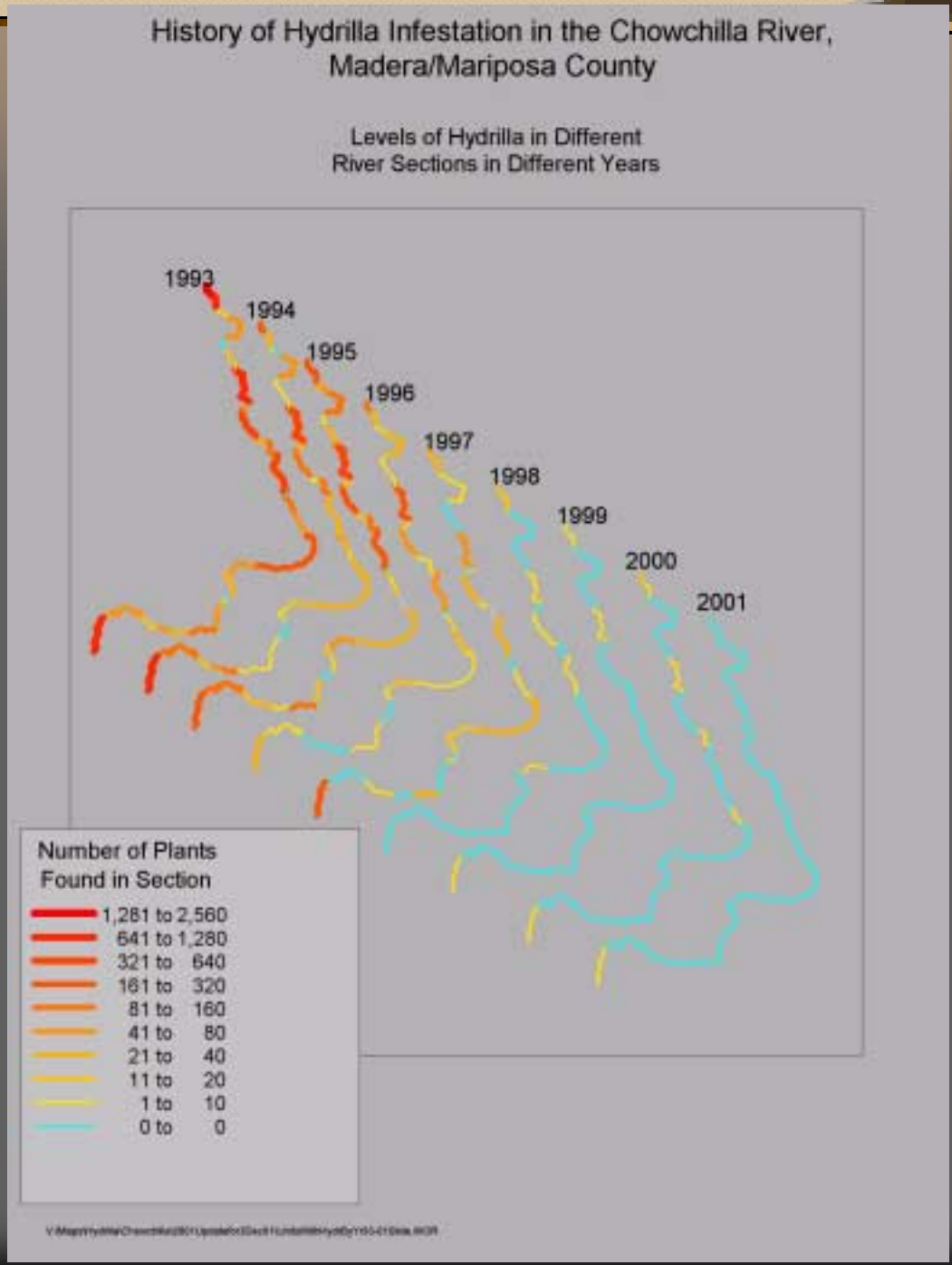


Chowchilla River / Eastman Lake: Results



Overall Results:

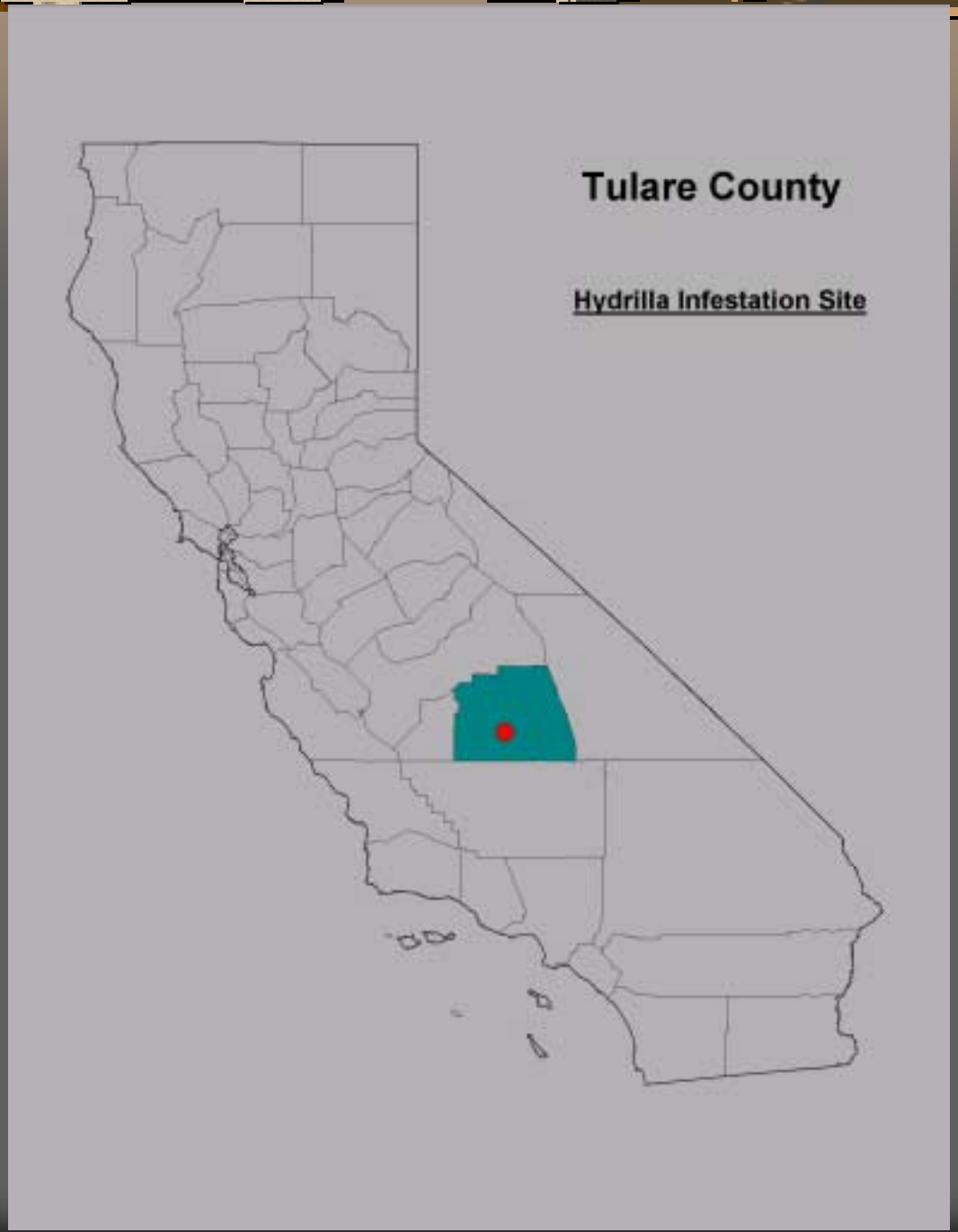
- Levels of hydrilla are very low and continue to drop.



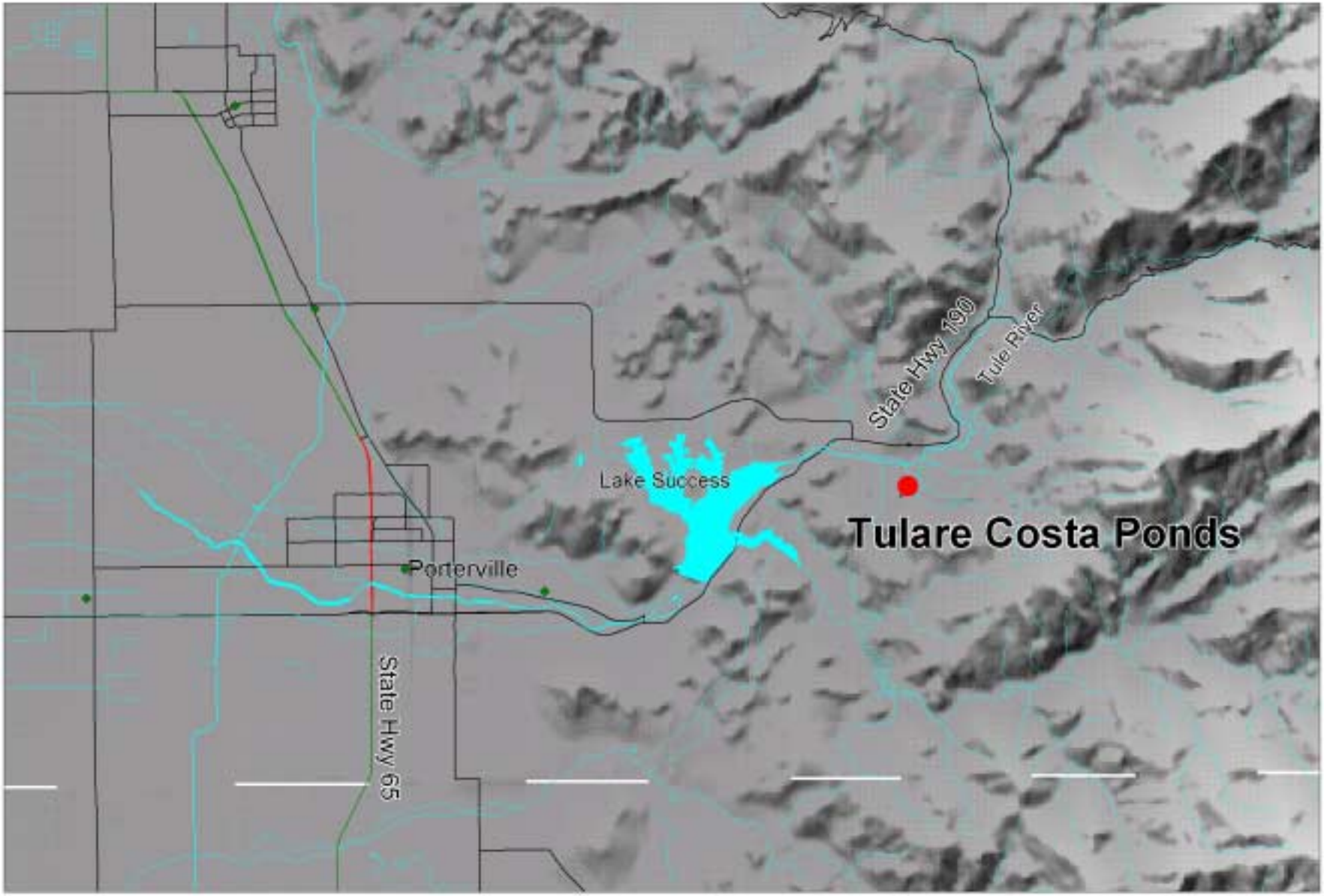
Tulare County -Costa Ponds 2001

- Local leadership
  - CAC: Lenord Craft
  - CDFA: Frank Zarate, Florence Maly
- Components
  - Quarantine
  - Survey
  - Manual removal, dredging, and herbicide treatment

Tulare County Costa Ponds 2001



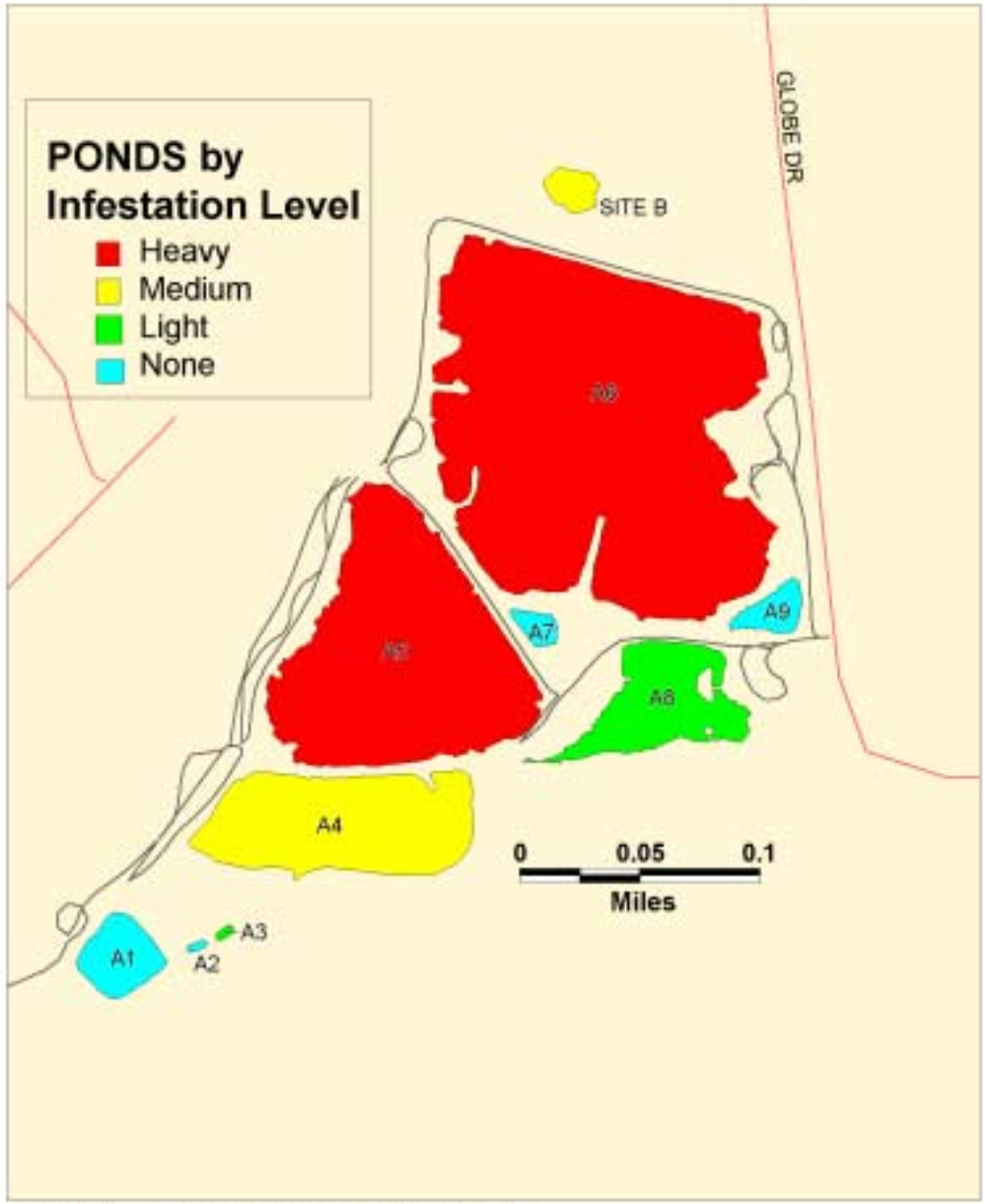
Costa Ponds Hydrilla Eradication Project, Tulare County



Costa Ponds

- Originally the infestations ranged from very heavy to none

Costa Lakes Hydrilla Eradication Project, Tulare County
Original Infestation Levels (1996).



Pond A6 in 1996 just after discovery

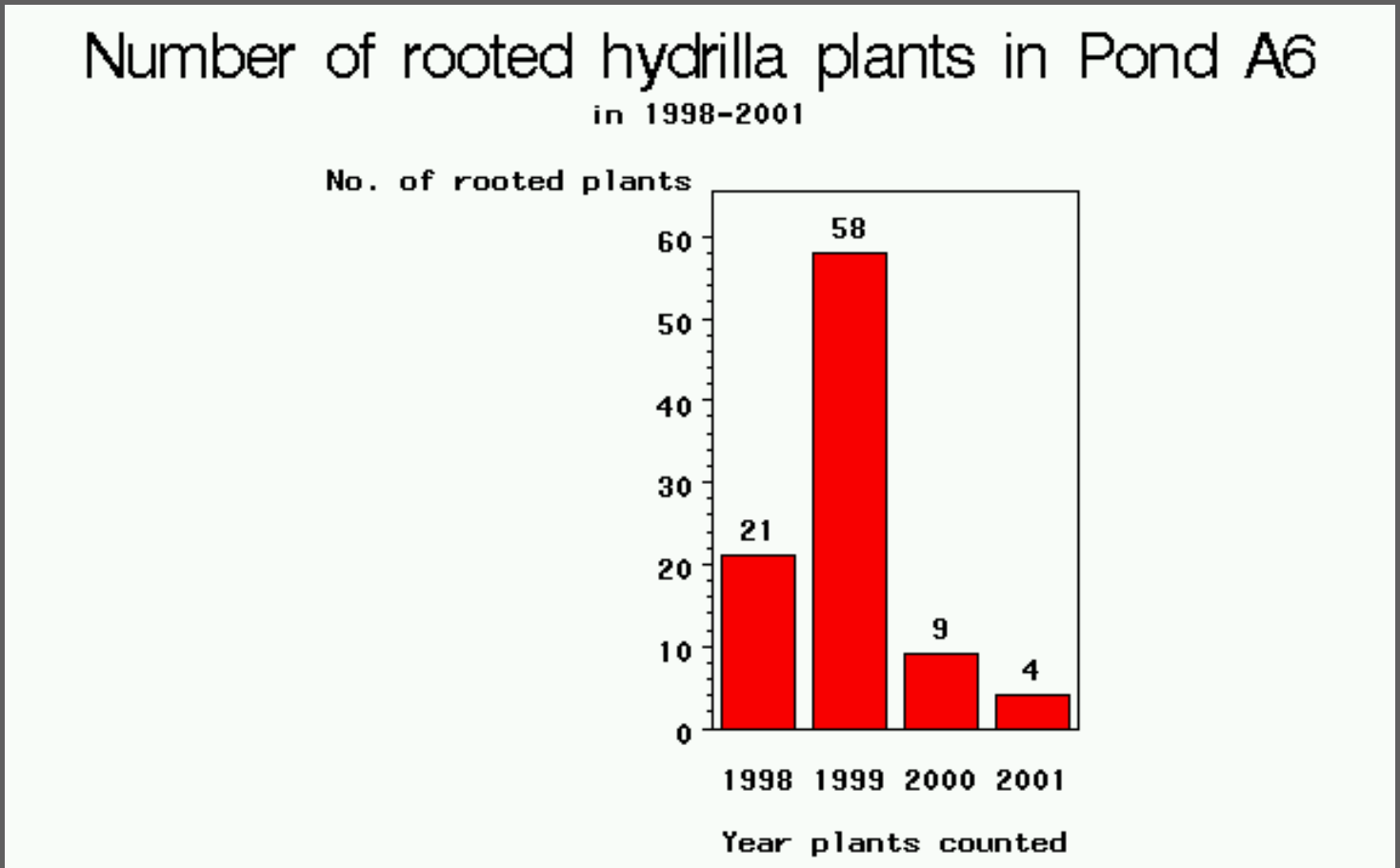
Costa Ponds Survey Efforts and Results 2001

- Infested ponds surveyed 10-20 times
- Found 4 rooted plants in pond A6 in mid Nov., otherwise found fragments only (1 in A5, 9 in A6, 1 in A8).
- Non-infested ponds surveyed 10-15 times. No hydrilla.
- No hydrilla in Tule River, Lake Success, or any other ponds in eradication area.

Costa Ponds Treatments 2001

- All ponds that ever had hydrilla were treated with fluridone, totaling 60-95 ppb
- First treatment May 29, last Sept. 27

Treatment Results: Pond A6 as of Nov. 2001



Pond A6 in 1996 just after discovery

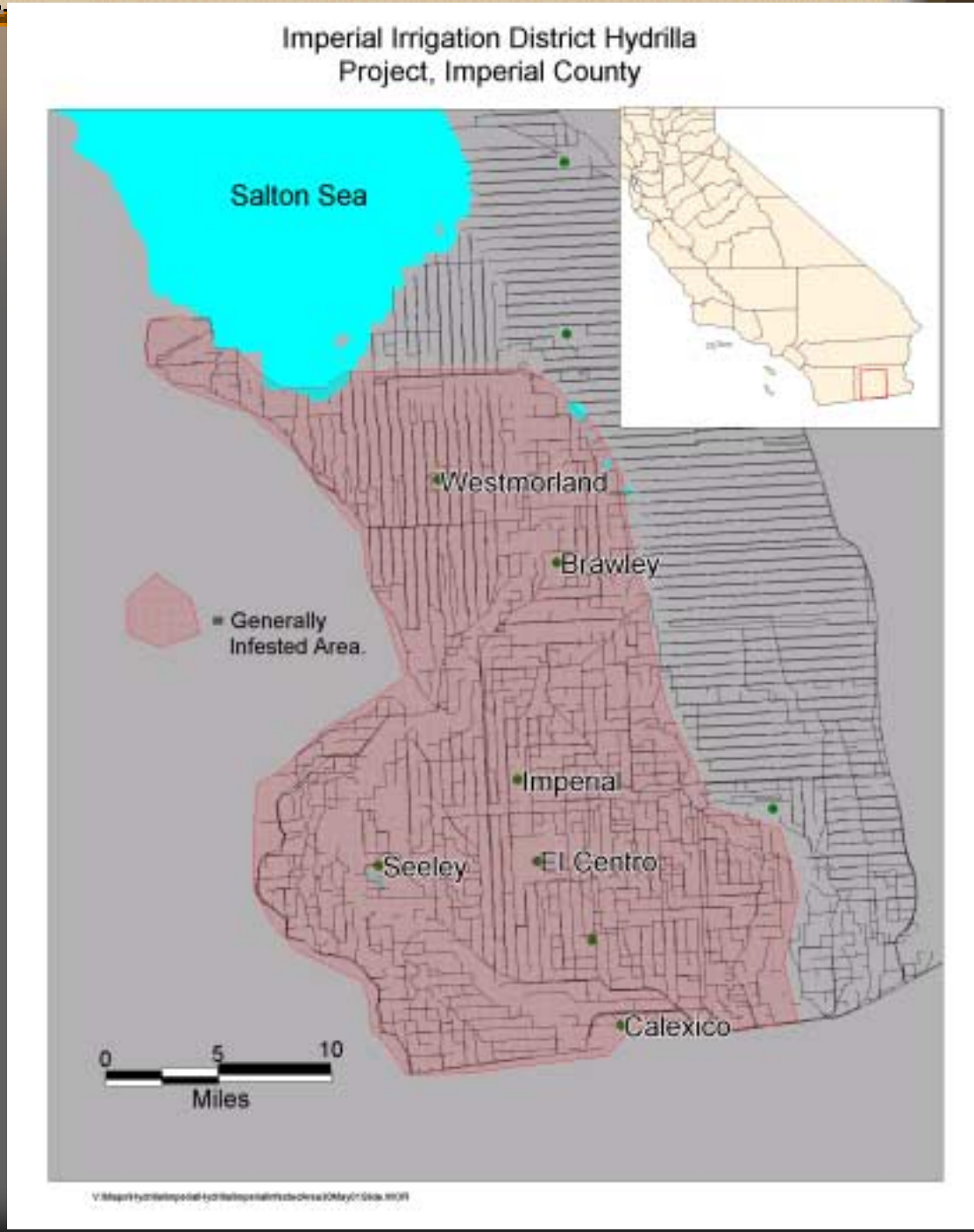
Pond A6 in Nov. 2001

Pond A6 Since Treatment

Imperial County Irrigation System 2001

- Local leadership
  - Imperial Irrigation District: Mike Mizumoto
  - CAC: Stephan Birdsall
  - CDFA: Daud Senzai
- Components
  - Quarantine
  - Survey
  - Manual removal, Dredging, and Herbicide treatment
  - Fish Stocking
  - Public Awareness

Imperial County Irrigation System 2001



Imperial County 2001

- Survey Results:
- Four sites with hydrilla

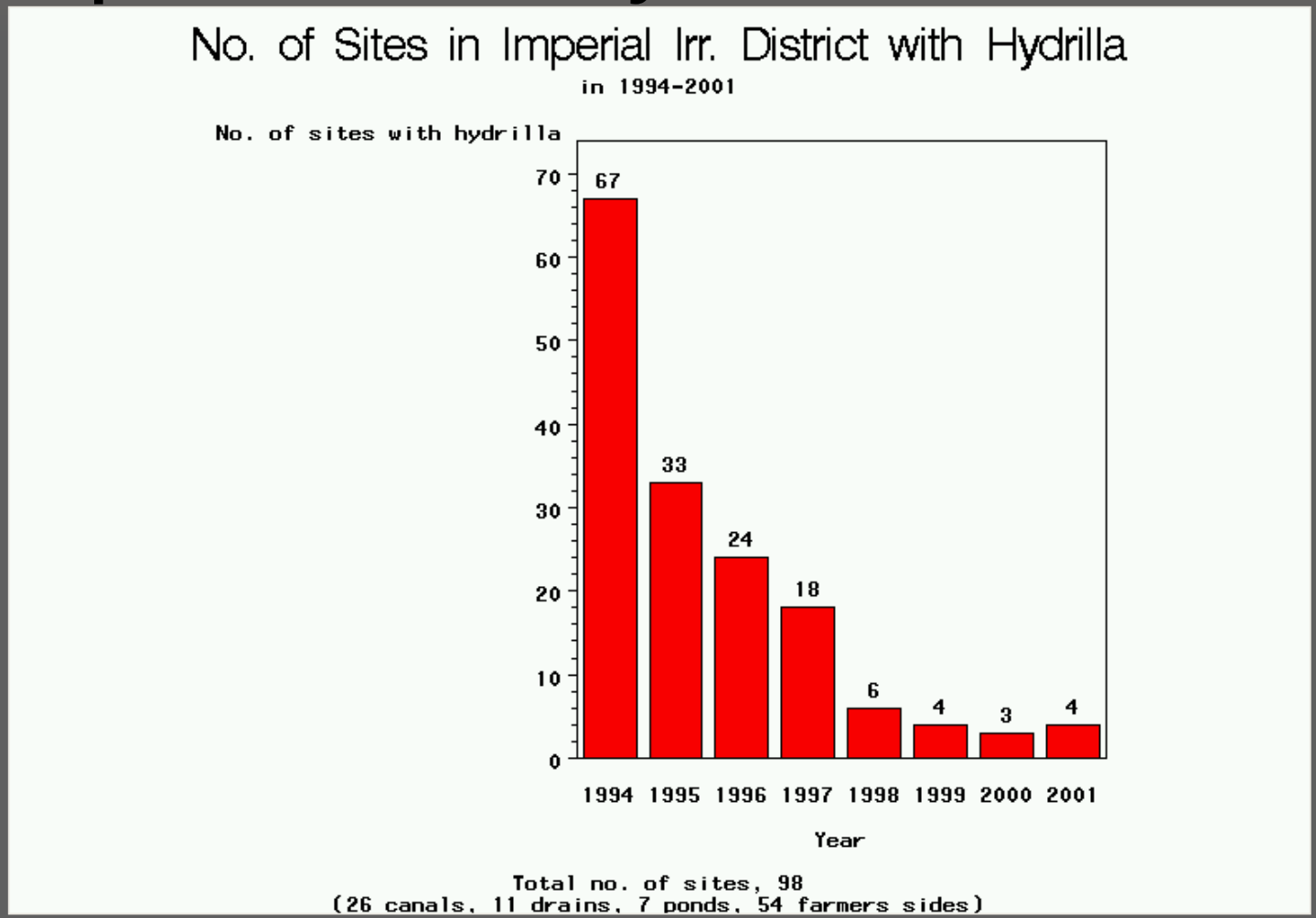
Imperial Irrigation District 2001

- 2001 detections and treatments
  - Wildcat drain: mechanical excavation, manual removal, and dredging
  - Fillaree Spill: Triploid grass carp
  - Spruce Lat 4: Manual removal. Intermittent water
  - Wisteria 7 drain: mechanical excavation, manual removal, dredging

Hydrilla- Imperial Irrigation District 1986

Approx. 600 miles of canal
Infested in 1986; approx.
2 miles with scattered plants
In 2000

Imperial County 2001



Imperial County triploid grass carp

Imperial County 2001

No. of triploid grass carp stocked in hydrilla infested areas

Year	Canals & laterals	Ponds & reservoirs	Total
2000	2218	214	2432
2001	2635	196	2831

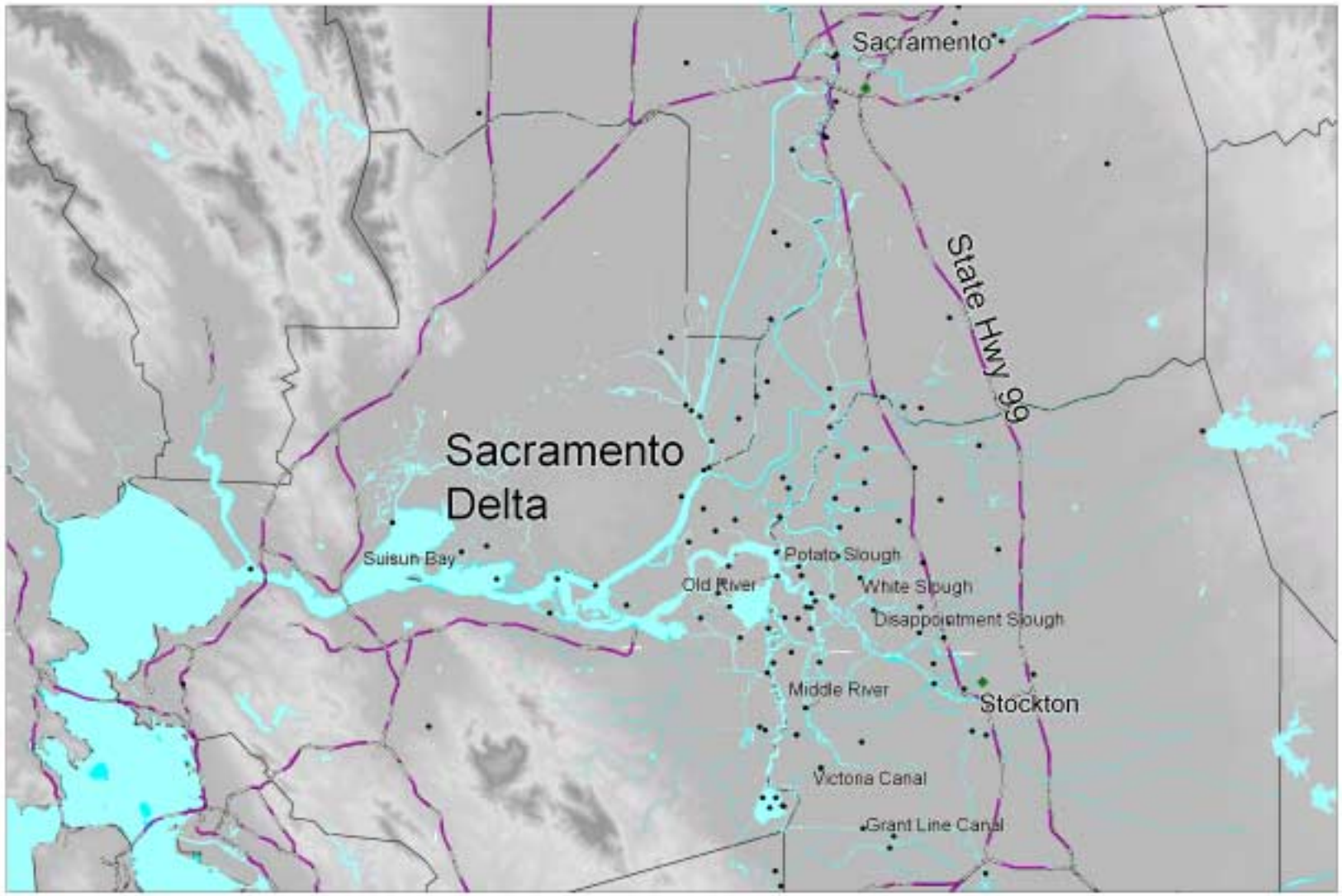
Imperial Irrigation District-Public Awareness-2000 and 2001

- Pamphlet on distinguishing triploid grass carp from common carp and legalities of possession
- Newspaper article on program
- Tours of fish production facility: 4/5 per year by government agencies, schools, interested groups
  - In 2003 will host tour of World Aquaculture Assoc.
- Booth at California mid-winter fair in Imperial Co. (1999)

DELTA HYDRILLA SURVEY 2001

- Local leadership
  - CDFA: Robin Breckenridge, Rod Kerr, Frank Zarate, Florence Maly, Tom Patrick, Denis Griffin
- Components
  - Survey and Detection
  - Public Awareness

DELTA HYDRILLA SURVEY



DELTA HYDRILLA SURVEY 2001

- Areas surveyed
  - Suisun bay, Middle River,Old River, Potato slough, White's slough, Disappointment slough, Stockton deepwater, Victoria channel, Grant Line canal, etc.
  - Lower reaches of Cache Creek, Bear Creek, Sacramento River, Feather River, San Joaquin River
- Timing
  - Mid to late fall when hydrilla plants and mats should be most obvious if they exist
- Results
  - No hydrilla detected anywhere in Delta

2001 DELTA HYDRILLA SURVEY

HYDRILLA ERADICATION PROGRAM

2001-Summary, page 1

- Surveys and public reports have not detected any substantial new infestations of hydrilla in the State
- Quarantine, Exclusion, and Public Awareness appear to be containing the spread of hydrilla
- The amount of hydrilla in known infestations is declining in most areas (fewer plants, tubers, finds, sites) indicating that treatment, dredging, and triploid grass carp protocols are effective

HYDRILLA ERADICATION PROGRAM

2001-Summary, page 2

- However, the rate of decline is slowing indicating a long period of low infestations before eradication
- Hydrilla appearing to move downstream in Clear Lake
- Though hydrilla not yet eradicated from the State, it is contained at present, and
- Sacramento Delta and major rivers are still hydrilla free